

SWORN**TRANSLATION**

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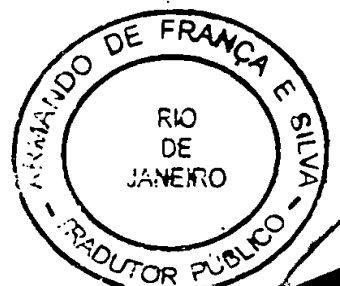
TRANSLATION NO. 6427-99

(Weapons)

FEDERAL REPUBLIC OF BRAZIL

Ministry of Industry, Trade and Tourism

National Industrial Property Agency



1
LETTERS PATENT # PI 9300292-0

5 Invention Privilege

The National Industrial Property Agency,
with a view to insuring property rights and the
exclusive use of a privilege, pursuant to the
attachments, and in consonance with laws in
10 force, and preserving third party rights and
Government responsibility vis-à-the novelty and
the usefulness, herewith issues the present
Letters Patent, pursuant to features and
conditions hereinunder set forth:

15 (21) Number of Deposit: PI 93000292-0

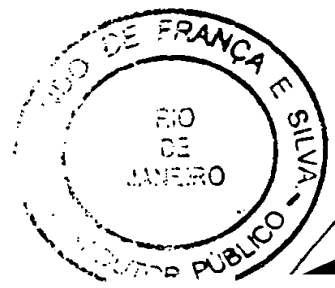
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(54) Title: **IMPROVED NOZZLE VALVE SEATS**

(73) Owner: Petróleo Brasileiro S/A - Petrobrás,
Mixed Economy Corporation



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Period of Validity: 20 (twenty) years as of
27/01/1993, with observance of legal
stipulations.

Issued 24 November 1998.

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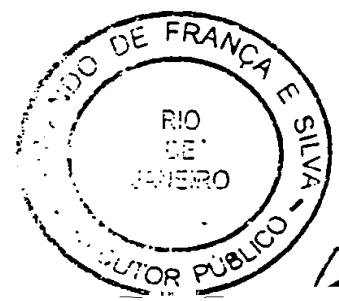
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1 P.I.9300292

5 Description of Invention: "Improved Nozzle
Valve Seats".

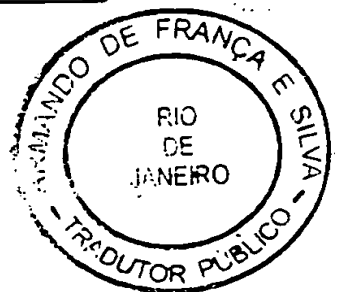
BACKGROUND OF THE INVENTION

10 The present invention relates to improvements
in nozzle valve seats, utilized in oil wells
producing pursuant the continuous gas lift
procedure.

DESCRIPTION OF PRIOR ART

15 In oil wells producing pursuant to
continuous gas lift procedure, for well
operations one commonly utilizes a valve normally
named "nozzle valve". Gas originating from
annular space between cover - production line
20 for the latter - flows thru said valve. Said gas
is responsible for well production pursuant to a
given flow rate.

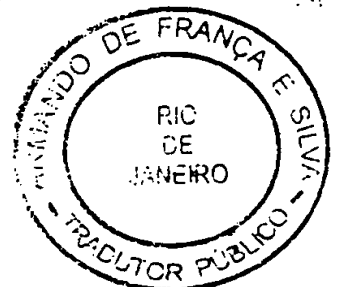
25 Nozzle valves are basically composed of a
nozzle with diameter previously determined (also
named seat or door) without changes in same as



1 long as valve is located within well area. Gas
flow thru said nozzle features a high degree of
irreversibility, thus promoting an expressive
5 loss of cargo, in addition to rendering difficult
gas flow rate calculations admitted for passage
thru same unit, thus compounding both project
and analysis.

10 **SUMMARY OF INVENTION**

In consonance with the present invention, an
improved seat of this type of valve is proposed,
utilizing optimized geometrical seat features,
according to which gas flow within valve will
15 resemble an isoentropical flow, considerably
cutting down side effects effects already
expressed in the earlier geometry. This new
proposal is based on the utilization of the so
called "compact venturi", which implies in
20 coupling of a convergent mouthpiece with a
conical diffuser unit. Said device is nearly as
efficient as a traditional venturi unit, being
however shorter (which is required in the case of
25



1 a valve) and being considerably easier to
manufacture, thus offering lower cost features.

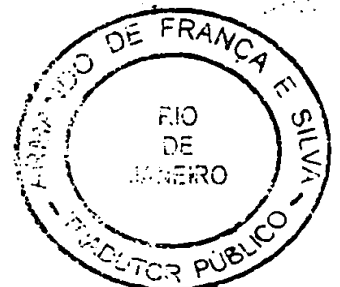
5 Utilization of this geometry will enhance an
increment of roughly 20% in viable gas flow rate
thru valve vis-à-vis an identical pressure
offset between covering and line, or, on the
other hand, will imply in a 76% - 20% decrease in
cover pressure required to handle identical gas
10 flow rate with identical line pressure (the most
common cases should be close to the upper range
value).

15 A striking example, evidencing the adequacy
of said new valve described herein is the case
of deep water satellite wells, where a host of
large flow rates with high pressure levels is
present.

20 **SHORT DESCRIPTION OF DRAWINGS**

The invention will now be described in more
detail, based on the attached drawings,
featuring:

25



1 Figure 1 - partial cut view of nozzle valve
of type now utilized with enlarged detail,
featuring cut of seat;

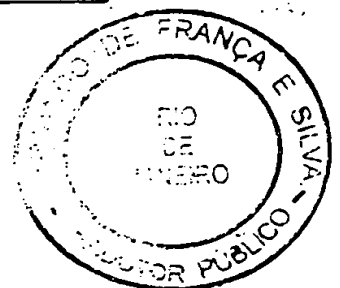
5 Figure 2 - schematic view of detail of seat,
featured in detail;

 Figure 3 - schematic view of detail,
featuring cut of seat, illustrating gas flow thru
same; and

10 Figure 4 - enlarged, schematic cut view of
improved seat, utilized in nozzle valve.

DETAILED DESCRIPTION OF INVENTION

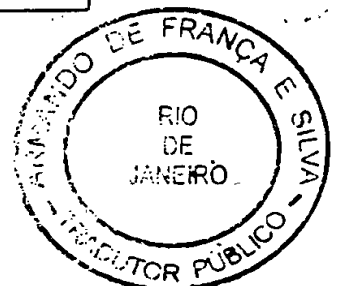
15 Figure 1 evidences a nozzle type pneumatic
lift valve seat, currently utilized. Figure 1
evidences point designated "A", indicating gas
admission to inside valve section, flowing thru
seat (specifically, the nozzle) "B" and escaping
20 thru nose section "C" towards tube inner
section. The same figure 1 outlines a detail of
cut of said seat, schematically reproduced in
Figure 2, where a valve cylinder body 1 can be
noticed, the seat housing 2, seat 4, nozzle 4 and
25 0-ring 5.



1 It can be seen that seat 3 is simply a disc
unit with a cylindrical straight hole pursuant
to diameter desired. General edge shaped
5 sections are sharp, but there are cases in which
a small bevelled section 66 is foreseen.

Figure 3 features a flow line scheme thru
nozzle 4, pursuing a path thru seat 3. Sudden
contraction and expansion features cause vortexes
10 originating intense loss of load. In addition,
the smaller flow area does not occur along the
restricted section (seat), but farther ahead,
pursuant to a phenomenon called "vena contracts".

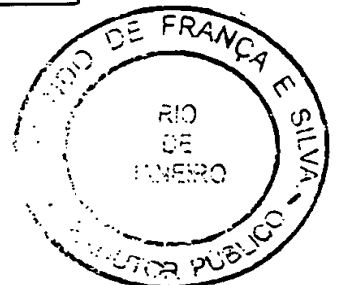
15 Conventional modelling feature consists in
presupposing isentropical escape (reversible
adiabatic), with final integration of a
correction coefficient (discharge coefficient)
and theoretical results are being compared with
experimental results. Neverthelsss, said
20 discharge coefficient is difficult to be
expressed, since it is contingent upon several
factors, many being intangible and based on a
theoretical modelling viewpoint. Subsequently,
25 project and the continuous gas lift procedure



1 are being handicapped, since these are contingent
upon correct gas flow rate calculations thru
valves. On the other hand, irreversibility
5 factors imply in extra load losses in system
(which unnecessarily are changed into heat).

With a view to minimizing problems outlined
above, according to the present invention a novel
geometry is being proposed for seat 7, shown in
10 an enlarged schematic cut view in figure 4.

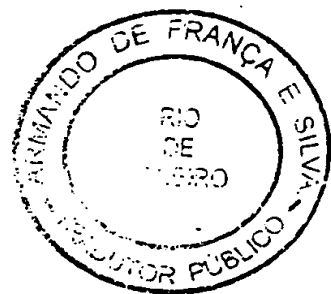
The improved seat 7 features an upper curved
section 8, an intermediate vertical straight
section 9 and an inclined lower straight section
10 with central spacing 11 representing a first
15 section, featuring a format of a converging
mouthpiece wherein gas is gradually being
accelerated, a second portion 13 which is a
cylindrical section of equal diameter of desired
nozzle and corresponds to main flux restriction,
20 and a third section 14, evidencing a conical
diffuser format, wherein gas is gradually being
decelerated. With these measures,
irreversibilities are reduced and the lower flow
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1 rate area coincides with the second section 13,
avoiding said "vena contracts".

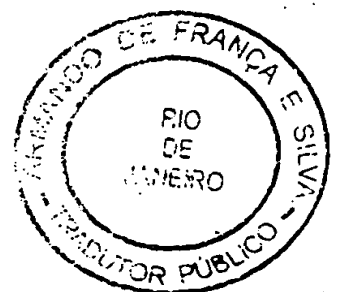
5 The α angle defining length h_1 of the third
section 14 is restricted by length available
(which is more critical for 1 1/2" valves, unless
changes are being effected in valve body).
diameter d_1 may coincide with d_α , however,
10 generally, due to assembly aspects, it should be
slightly inferior. In the same way, a second
portion 13 may be theoretically reduced to a
simple section, however - also due to practical
questions - should always feature a certain
15 length h_α , even of small extent, with h_α
representing the length of the first section 12
with outer contours resembling a convergent
mouthpiece.

20 In applicable literature, said unit is often
called "compact Venturi", since it resembles the
common venturi, being much shorter though and
easy to manufacture, but does not evidence
remarkable performance levels.



C l a i m s

1. Improved nozzle valve seats used in oil wells pursuant to a continuous pneumatic gas lift operational feature, consisting of a cylinder shaped body (1) into which gas flow is admitted thru an intermediate nozzle (A), passing thru seat (B) and being discharged in lower section thru nose section (C), characterized in that said improved nozzle valve seat comprises a seat (7), featuring a curved (8) upper section, a straight vertical section (9) and an inclined lower straight section (10) with central spacing (11) representing a first section (12), with a format similar to a convergent mouthpiece in which gas is gradually being accelerated, a second section (13) corresponding to main flow restriction feature, as well as a third section (14) similar to a conical diffuser unit in which gas is gradually being decelerated.



A B S T R A C T

Description of invention: "Improved nozzle valve seats".

The present invention relates to improved nozzle valve seats used in oil wells with a continuous gas lift production feature, comprising a seat (7) featuring a curved upper section (B), a vertical straight section (9) and a straight inclined lower section (10) with central spacing (11), representing a first section (12) similar to a convergent mouthpiece, in which gas is being gradually accelerated, a second section (13) corresponding to main flow restriction feature, as well as a third section (14) similar to a conic diffuser unit, in which gas is being gradually decelerated.

Rio de Janeiro, August 23, 1999.

WITNESS MY HAND AND SEAL

